

WE CLAIM:

1. A cell comprising a nucleic acid molecule wherein said nucleic acid molecule comprises:
  - a) one or more target binding domains wherein said target binding domain is between 10 and 600 nucleotides in length and that target binding of the nucleic acid molecule to a target pre-mRNA expressed within a cell;
  - b) a 3' splice region comprising a branchpoint, a pyrimidine tract and a 3' splice acceptor site;
  - c) a spacer region that separates the 3' splice region from the target binding domain; and
  - d) nucleotide sequence to be trans-spliced to the target pre-mRNA; wherein said nucleic acid molecule is recognized by nuclear splicing components within the cell.
2. A cell comprising a nucleic acid molecule wherein said nucleic acid molecule comprises:
  - a) one or more target binding domains wherein said target binding domain is between 10 and 600 nucleotides in length and that target binding of the nucleic acid molecule to a target pre-mRNA expressed within a cell

- b) a 5' splice site;
- c) a spacer region that separates the 5' splice site from the target binding domain; and
- d) a nucleotide sequence to be trans-spliced to the target pre-mRNA;

wherein said nucleic acid molecule is recognized by nuclear splicing components within the cell.

- 3. The cell of claim 1 wherein the nucleic acid molecule further comprises a 5' donor site.
- 4. The cell of Claim 1 wherein the nucleic acid molecule further comprises a safety nucleotide sequence comprising one or more complementary sequences that bind to one or more sides of the 3' splice region.
- 5. The cell of Claim 2 wherein the nucleic acid molecule further comprises a safety nucleotide sequence comprising one or more complementary sequences that bind to one or more sides of the 5' splice region.
- 6. The cell of Claim 1 wherein the nucleic acid molecule further comprises sequences encoding a translatable protein product.

7. The cell of Claim 1 or 3 wherein the nucleic acid molecule further comprises a nucleotide sequence containing a translational stop codon.
8. A cell comprising a recombinant vector wherein said vector expresses a nucleic acid molecule comprising:
- a) one or more target binding domains wherein said target binding domain is between 10 and 600 nucleotides in length and that target binding of the nucleic acid molecule a target pre-mRNA expressed within a cell;
  - b) a 3' splice region comprising a branchpoint, a pyrimidine tract and a 3' splice acceptor site;
  - c) a spacer region that separates the 3' splice region from the target binding domain; and
  - d) a nucleotide sequence to be trans-spliced to the target pre-mRNA; wherein said nucleic acid molecule is recognized by nuclear splicing components within the cell.
9. A cell comprising a recombinant vector wherein said vector expresses a nucleic acid molecule comprising:
- a) one or more target binding domains wherein said target binding domain is between 10 and 600 nucleotides in length and that target

binding of the nucleic acid molecule a target pre-mRNA  
expressed within a cell;

- b) a 5' splice site;
- c) a spacer region that separates the 5' splice site from the target  
binding domain; and
- d) a nucleotide sequence to be trans-spliced to the target pre-mRNA;  
wherein said nucleic acid molecule is recognized by nuclear  
splicing components within the cell.

10. The cell of claim 8 wherein the nucleic acid molecule further comprises a  
5' donor site.

11. A method of producing a chimeric RNA molecule in a cell comprising:  
contacting a target pre-mRNA expressed in the cell with a nucleic acid  
molecule recognized by nuclear splicing components wherein said nucleic  
acid molecule comprises:

- a) one or more target binding domains wherein said target binding  
domain is between 10 and 600 nucleotides in length and that target  
binding of the nucleic acid molecule to a target pre-mRNA  
expressed within a cell;
- b) a 3' splice region comprising a branchpoint, a pyrimidine tract and  
a 3' splice acceptor site;

- c) a spacer region that separates the 3' splice region from the target binding domain; and
- d) a nucleotide sequence to be trans-spliced to the target pre-mRNA; under conditions in which a portion of the nucleic acid molecule is trans-spliced to a portion of the target pre-mRNA to form a chimeric RNA within the cell.

12. A method of producing a chimeric RNA molecule in a cell comprising: contacting a target pre-mRNA expressed within the cell with a nucleic acid molecule recognized by nuclear splicing components wherein said nucleic acid molecule comprises:

- a) one or more target binding domains wherein said target binding domain is between 10 and 600 nucleotides in length and that target binding of the nucleic acid molecules target pre-mRNA expressed within a cell;
- b) a 5' splice site;
- c) a spacer region that separates the 5' splice site from the target binding domain; and
- d) a nucleotide sequence to be *trans*-spliced to the target pre-mRNA;

wherein said nucleic acid molecule is recognized by nuclear splicing components within the cell.

13. A method of claim 11 wherein the nucleic acid molecule further comprises a 5' donor site.
14. The method of claim 11, wherein the chimeric RNA molecule comprises sequences encoding a translatable protein.
15. The method of claim 11, wherein the chimeric RNA molecule comprises sequences encoding a toxin.
16. A nucleic acid molecule comprising:
  - a) one or more target binding domains wherein said target binding domain is between 10 and 600 nucleotides in length and that target binding of the nucleic acid molecule to a target pre-mRNA expressed within a cell;
  - b) a 3' splice region comprising a branchpoint, a pyrimidine tract and a 3' splice acceptor site;
  - c) a spacer region that separates the 3' splice region from the target binding domain;
  - d) a safety sequence comprising one or more complementary sequences that bind to one or both sides of the 3' splice site; and

- e) a nucleotide sequence to be trans-spliced to the target pre-mRNA; wherein said nucleic acid molecule is recognized by nuclear splicing components within the cell.

17. A nucleic acid molecule comprising :

- a) one or more target binding domains wherein said target binding domain is between 10 and 600 nucleotides in length and that target binding of the nucleic acid molecule a target pre-mRNA expressed within a cell;
- b) a 5' splice site;
- c) a spacer region that separates the 5' splice site from the target binding domain;
- d) a safety sequence comprising one or more complementary sequences that bind to one or both sides of the 5' splice site; and
- e) a nucleotide sequence to be trans-spliced to the target pre-mRNA; wherein said nucleic acid molecule is recognized by nuclear splicing components within the cell.

18. The nucleic acid molecule of claim 16 wherein the nucleic acid molecule further comprises a 5' donor site.

19. The nucleic acid molecule of claim 16 or 17 wherein the nucleic acid molecule further comprises sequences encoding a translatable protein product.
20. The nucleic acid molecule of claim 16 or 17 wherein the translatable protein product is a toxin.
21. An expression vector wherein said vector expresses a nucleic acid molecule comprising:
  - a) one or more target binding domains wherein said target binding domain is between 10 and 600 nucleotides in length and that target binding of the nucleic acid molecule to a target pre-mRNA expressed within a cell;
  - b) a 3' splice region comprising a branchpoint, a pyrimidine tract and a 3' splice acceptor site;
  - c) a spacer region that separates the 3' splice region from the target binding domain; and
  - d) nucleotide sequence to be trans-spliced to the target pre-mRNA; wherein said nucleic acid molecule is recognized by nuclear splicing components within the cell.



22. A eukaryotic expression vector wherein said vector expresses a nucleic acid molecule comprising:
- a) one or more target binding domains wherein said target binding domain is between 10 and 600 nucleotides in length and that target binding of the nucleic acid molecule to a target pre-mRNA expressed within a cell;
  - b) a 5' splice site;
  - c) a spacer region that separates the 5' splice site from the target binding domain; and
  - d) a nucleotide sequence to be trans-spliced to the target pre-mRNA;

wherein said nucleic acid molecule is recognized by nuclear splicing components within the cell.

23. The vector of claim 21 wherein the nucleic acid molecule further comprises a 5' donor site.
24. The expression vector of claim 21 or 22 further comprising a safety sequence comprising one or more complementary sequences that bind to one or both sides of the splice site.

25. A cell comprising a nucleic acid molecule wherein said nucleic acid molecule comprises:
- a) a 3' splice region comprising a branch point, a pyrimidine tract and a 3' splice acceptor site; and
  - b) a nucleotide sequence to be *trans*-spliced to the target pre-mRNA; wherein said nucleic acid molecule is recognized by nuclear splicing components within the cell.
26. A cell comprising a nucleic acid molecule wherein said nucleic acid molecule comprises:
- a) a 5' splice site;
  - c) a spacer region that separates the 5' splice site from the target binding domain; and
  - d) a nucleotide sequence to be trans-spliced to the target pre-mRNA; wherein said nucleic acid molecule is recognized by nuclear splicing components within the cell.
27. The cell of claim 25 wherein the nucleic acid molecule further comprises a 5' donor site.
28. The cell of claim 25 or 26 wherein the nucleotide sequences to be trans-spliced to the target pre-mRNA comprises a nucleotide sequence tag.

29. A cell comprising a recombinant vector wherein said vector expresses a nucleic acid molecule comprising:
- a) a 3' splice region comprising a branchpoint, a pyrimidine tract and a 3' splice acceptor site; and
  - b) a nucleotide sequence to be *trans*-spliced to the target pre-mRNA; wherein said nucleic acid molecule is recognized by nuclear splicing components within the cell.
30. A cell comprising a recombinant vector wherein said vector expresses a nucleic acid molecule comprising:
- a) a 5' splice site; and
  - b) a nucleotide sequence to be *trans*-spliced to the target pre-mRNA; wherein said nucleic acid molecule is recognized by nuclear splicing components within the cell.
31. The cell of claim 29 wherein the nucleic acid molecule further comprises a 5' donor site.
32. A method of producing a chimeric RNA molecule in a cell comprising: contacting a target pre-mRNA expressed in the cell with a nucleic acid molecule recognized by nuclear splicing components wherein said nucleic acid molecule comprises:

- a) a 3' splice region comprising a branch point, a pyrimidine tract and a 3' splice acceptor site; and
- b) a nucleotide sequence to be *trans*-spliced to the target pre-mRNA; under conditions in which a portion of the nucleic acid molecule is trans-spliced to a portion of the target pre-mRNA to form a chimeric RNA within the cell.

33. A method of producing a chimeric RNA molecule in a cell comprising: contacting a target pre-mRNA expressed within the cell with a nucleic acid molecule recognized by nuclear splicing components wherein said nucleic acid molecule comprises:
- a) a 5' splice site; and
  - d) a nucleotide sequence to be *trans*-spliced to the target pre-mRNA; wherein said nucleic acid molecule is recognized by nuclear splicing components within the cell.
34. A method of claim 32 wherein the nucleic acid molecule further comprises a 5' donor site.
35. The method of claim 32, wherein the chimeric RNA molecule comprises a nucleotide sequence tag.

36. An eukaryotic expression vector wherein said vector expresses a nucleic acid molecule comprising:
- a) a 3' splice region comprising a branchpoint, a pyrimidine tract and a 3' splice acceptor site; and
  - b) a nucleotide sequence to be *trans*-spliced to the target pre-mRNA; wherein said nucleic acid molecule is recognized by nuclear splicing components within the cell.
37. An eukaryotic expression vector wherein said vector expresses a nucleic acid molecule comprising:
- a) a 5' splice site; and
  - d) a nucleotide sequence to be *trans*-spliced to the target pre-mRNA; wherein said nucleic acid molecule is recognized by nuclear splicing components within the cell.
38. The vector of claim 36 wherein the nucleic acid molecule further comprises a 5' donor site.
39. An expression library comprising recombinant expression vectors wherein said vectors expresses a nucleic acid molecule comprising:
- a) a 3' splice region comprising a branchpoint, a pyrimidine tract and a 3' splice acceptor site; and

- d) a nucleotide sequence to be *trans*-spliced to the target pre-mRNA;  
wherein said nucleic acid molecule is recognized by nuclear  
splicing components within the cell.
40. An expression library comprising recombinant expression vectors wherein  
said wherein said vector expresses a nucleic acid molecule comprising:
- a) a 5' splice site; and
- b) a nucleotide sequence to be *trans*-spliced to the target pre-mRNA;  
wherein said nucleic acid molecule is recognized by nuclear  
splicing components within the cell.
41. The expression library of claim 39 wherein the nucleic acid molecule  
further comprises a 5' donor site.
42. The expression library of claim 39 or 40 wherein the nucleotide sequence  
to be spliced to the target pre-mRNA comprises a nucleotide sequence tag.
43. A method for mapping exon-intron boundaries in pre-mRNA molecules  
comprising:
- (i) contacting a nucleic acid molecule to a target pre-mRNA molecule,  
under conditions in which a portion of the nucleic acid molecule is

*trans*-spliced to a portion of the target pre-mRNA to form a chimeric mRNA;

- (ii) amplifying the chimeric mRNA molecule;
- (iii) selectively purifying the amplified molecule; and
- (iv) determining the nucleotide sequence of the amplified molecule thereby identifying the intron-exon boundaries.